

REMARKS

Claims 1-49 are currently pending in the application, with claims 1, 2, 19, 43 and 44 being independent. Claims 1-49 were pending prior to the Office Action. In this Reply, claims 1, 2, 19, 43 and 44 have been amended.

The Examiner is respectfully requested to reconsider the rejections in view of the amendments and remarks set forth herein. Applicant respectfully requests favorable consideration thereof in light of the amendments and comments contained herein, and earnestly seeks timely allowance of the pending claims.

Claim Rejections – 35 U.S.C. §103

The Examiner rejected claims 1, 3-5, 11, 13, 15, 18 and 43 under 35 U.S.C. § 103(a) as being unpatentable over US 6,137,535 (“Meyers”) in view of US 7,084,905 (“Nayar”). The Examiner rejected claims 6, 7 and 12 under 35 U.S.C. § 103(a) as being unpatentable over Meyers in view of Nayar further in view of US 7,139,028 (“Itano”). The Examiner rejected claims 8-10 under 35 U.S.C. § 103(a) as being unpatentable over Meyers in view of Nayar further in view of Itano and US 6,933,972 (“Suzuki et al.”). The Examiner rejected claim 14 under 35 U.S.C. § 103(a) as being unpatentable over Meyers in view of Nayar further in view of US 5,063,439 (“Tabei”). The Examiner rejected claims 16-17 under 35 U.S.C. § 103(a) as being unpatentable over Meyers in view of Nayar further in view of US 5,055,921 (“Usui”). The Examiner rejected claim 41 under 35 U.S.C. § 103(a) as being unpatentable over Meyers in view of Nayar in view of US 5,289,269 (“Sugimori”). The Examiner rejected claims 2, 19, 20, 22-25, 31, 33, 35, 38, 39, 40, 42, 44, 45 and 47-49 under 35 U.S.C. § 103(a) as being unpatentable over Meyers in view of US 2002/0113888 (“Sonoda”). The Examiner rejected claims 21, 26-27, 32 and 46 under 35 U.S.C. § 103(a) as being unpatentable over Meyers in view of Nayar in view of Sonoda further in view of Itano. The Examiner rejected claims 28-30 under 35 U.S.C. § 103(a) as being unpatentable over Meyers in view of Nayar in view of Sonoda further in view of Suzuki. The Examiner rejected claim 34 under 35 U.S.C. § 103(a) as being unpatentable over Meyers in view of Nayar in view of Sonoda further in view of Tabei. The Examiner rejected

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claims 36-37 under 35 U.S.C. § 103(a) as being unpatentable over Meyers in view of Nayar in view of Sonoda further in view of Usui.

Applicant traverses these rejections. Applicant has amended independent claims 1, 2, 19, 43 and 44.

Applicant has amended claim 1 to recite “wherein the inside of each of said photoelectric conversion areas is two-dimensionally partitioned into a plurality of segments which output a plurality of photoelectric conversion signals of different spectral sensitivities using transfer electrodes, wherein an aperture in said light-shielding film corresponds to at least two of said segments in one of said photoelectric conversion areas, and [...] wherein said plurality of different spectral sensitivities include red, green and blue of primary colors, and the diameter or the diagonal dimension of each said aperture satisfies the formula $\lambda \leq t \leq 2\lambda$ wherein t represents the diameter or the diagonal dimension of said aperture and λ represents the wavelength 0.650 μm of a red color.”

Applicant has amended claim 2 to recite “an inside of each of said photoelectric conversion areas is two-dimensionally partitioned into a plurality of segments which store signal electric charges of different spectral sensitivities, a light-shielding film wherein an aperture in said light-shielding film corresponds to at least two of said segments in one of said photoelectric conversion areas, wherein said different spectral sensitivities include red, green and blue of primary colors, and the diameter or the diagonal dimension of said aperture satisfies the formula $\lambda \leq t \leq 2\lambda$ wherein t represents the diameter or the diagonal dimension of said aperture and λ represents the wavelength 0.650 μm of a red color.”

Applicant has also amended claim 19 to recite “an inside of each of said photoelectric conversion areas is two-dimensionally partitioned into a plurality of segments which output photoelectric conversion signals having a plurality of different spectral sensitivities, a light-shielding film wherein an aperture in said light-shielding film corresponds to at least two of said segments in one of said photoelectric conversion areas, wherein said plurality of different spectral sensitivities include red, green and blue of primary colors, and the diameter or the diagonal dimension of each said aperture satisfies the formula $\lambda \leq t \leq 2\lambda$ wherein t represents

the diameter or the diagonal dimension of said aperture and λ represents the wavelength 0.650 μm of a red color.”

Applicant has amended claim 43 to recite “a plurality of photoelectric conversion areas [...], an inside of each of said photoelectric conversion areas being two-dimensionally partitioned into a plurality of segments which output a plurality of photoelectric conversion signals of different spectral sensitivities, and light-shielding means, wherein an aperture in said light-shielding means corresponds to at least two of said segments in one of said photoelectric conversion areas, [...] wherein said plurality of different spectral sensitivities include red, green and blue of primary colors, and the diameter or the diagonal dimension of each said aperture satisfies the formula $\lambda \leq t \leq 2\lambda$ wherein t represents the diameter or the diagonal dimension of said aperture and λ represents the wavelength 0.650 μm of a red color.”

Applicant has also amended claim 44 to recite “signal storing means for storing electric charges of different spectral sensitivities in a plurality of segments which are partitioned by dividing an inside of a plurality of photoelectric conversion areas [...], a light-shielding film wherein an aperture in said light-shielding film corresponds to at least two of said segments in one of said photoelectric conversion areas, wherein said different spectral sensitivities include red, green and blue of primary colors, and the diameter or the diagonal dimension of each said aperture satisfies the formula $\lambda \leq t \leq 2\lambda$ wherein t represents the diameter or the diagonal dimension of said aperture and λ represents the wavelength 0.650 μm of a red color.”

The amendments to claims 1, 2, 19, 43 and 44 are supported by at least the description at page 24 lines 27-31 in the specification as filed.

To establish a *prima facie* case of obviousness, the Examiner has the burden of meeting the basic criterion that the prior art must teach or suggest all of the claim limitations.

Regarding this basic criterion, the Applicant submits that the references do not teach or suggest a device in which the inside of each of said photoelectric conversion areas is two-dimensionally partitioned into a plurality of segments which output a plurality of photoelectric conversion signals of different spectral sensitivities using transfer electrodes, wherein an aperture in said light-shielding film corresponds to at least two of said segments in one of said

photoelectric conversion areas, and wherein said plurality of different spectral sensitivities include red, green and blue of primary colors, and the diameter or the diagonal dimension of each said aperture satisfies the formula $\lambda \leq t \leq 2\lambda$ wherein t represents the diameter or the diagonal dimension of said aperture and λ represents the wavelength 0.650 μm of a red color, as recited in claim 1 or the features reciting the diameter or diagonal dimension of the aperture t in claims 2, 19, 43 and 44.

Meyers merely discloses a compact digital camera formed with a lenslet array 10 comprised of a plurality of lenslets 12, each lenslet having a decentration corresponding to its radial position in the lenslet array 10 so that the axial ray of each lenslet 12 views a different segment of a total field of view. A photosensor array 20 comprised of a plurality of sub-groups of photodetectors 22 is positioned such that each sub-group 22 is located along the axial ray of a respective lenslet 12. A field limiting baffle comprised of at least one aperture plate is positioned such that the centers of the apertures are located along the axial ray of a respective lenslet (Abstract, Figs. 1B and 2).

At col. 9 lines 55-63, Meyers explains that:

“although the lenslet array can operate at low F/#’s (F/2.0), it is advantageous to minimize the lenslet’s diameter (increasing F/#) so as to minimize the space between lens elements and therefore the image sensor’s overall dimensions. If one can achieve higher photo-signal gain with local signal processing electronics, lenslets with smaller numerical apertures can be used to generate the same level of photocurrent. This is accomplished by utilizing a multiplying current mirror.” Emphasis added.

Further, at col. 5 line 64- col. 6 line 14, Meyers explains that:

“the illumination incident on the photodetector array from a given lenslet is proportional to the $(F/\#)^2$. Therefore, if the sensitivity is increased by x , the $F/\#$ can be reduced by $x^{1/2}$. For instance, if an array optic camera, without a multiplying current mirror, is used with a lenslet having a $F/\#=4.0$ and a $FL=3.0$ mm, the lenslet’s diameter would be 750 μm . [...] By incorporating a current mirror with a multiplication factor of 16 at each sub-array of photodetectors, the lenslet diameters can be reduced by 4x to 187 μm and the length of the array will be reduced to 14.6 mm, resulting in higher photosensor yields and lower part costs.” Emphasis added.

Therefore, the size range of the lenslet diameter in Meyer, which approximates the size of the opaque mask aperture is 180 μm or more and does not satisfy the formula $\lambda \leq t \leq 2\lambda$ recited in claim 1, with t representing the diameter or the diagonal dimension of said aperture and λ represents the wavelength 0.650 μm of a red color. Since both the sensitivity and the lenslet's diameter are inversely proportional to F/# (col. 5 lines 56-57 and 65-66 in Meyers), it appears impossible to scale down the device of Meyers to an aperture of the order of 0.650 μm as recited in claim 1, because such reduction in lenslet/aperture diameter would greatly increase the F/# and significantly decrease sensitivity of Meyer's device, likely making the device non-operational. As described in Meyers, the device is operational on a scale of 180 μm or more for lenslet / aperture diameter.

Nayar illustrates (for example Fig. 11) a light shields layer 113 with respective apertures 118 and 119 above the photosensitive surfaces 191 of the left and right light-sensing elements. Photodiodes have an associated transfer gate electrode 114 (col. 16 lines 16-18). Nayar does not disclose or suggest any photoelectric conversion area two-dimensionally partitioned into a plurality of segments which output a plurality of photoelectric conversion signals of different spectral sensitivities. Nayar also does not disclose or suggest that plurality of different spectral sensitivities for a partitioned photoelectric conversion area include red, green and blue of primary colors, and the diameter or the diagonal dimension of each aperture in a light-shielding film satisfies the formula $\lambda \leq t \leq 2\lambda$ wherein t represents the diameter or the diagonal dimension of said aperture and λ represents the wavelength 0.650 μm of a red color. Thus, Nayar does not disclose or suggest a small size device as claimed in claims 1, 2, 43 and 44 and sensor as claimed in claim 19.

Sonoda discloses a solid-state image pickup element in which each of pixel groups 102a to 102d are formed with a two-dimensional array of pixels 101, where a pixel 101 has a photodiode (Fig. 2). Itano discloses an image pick-up element including pixel areas 2a-2d, and in each pixel area multiple pixels are arranged two-dimensionally (col. 4 lines 65-67), i.e., each area 2a etc. includes multiple pixels, as illustrated in Fig. 8 and Fig. 14. Itano, Sonoda, Suzuki, Tabei, Usui and Sugimori do not disclose photoelectric conversion areas which are two-dimensionally partitioned into a plurality of segments which output a plurality of photoelectric

conversion signals of different spectral sensitivities as claims 1, 2, 19, 43 and 44 recite. For example, in Fig. 2 of Suzuki et al., photoconversion elements 10 (Fig. 1) are not partitioned into segments. Tabei, Usui and Sugimori do not discuss photoelectric conversion area segments and arrangement of transfer electrodes/transfer channels. A small size device as claimed in claims 1, 2, 43 and 44 or sensor as claimed in claim 19 in which a diameter or diagonal dimension of an aperture in a light-shielding film over a partitioned photoelectric conversion area satisfies the formula $\lambda \leq t \leq 2\lambda$ wherein t represents the diameter or the diagonal dimension of the aperture and λ represents the wavelength 0.650 μm of a red color, is not disclosed or suggested by these references.

Thus, none of the references teaches or suggests a small size device as claimed in claims 1, 2, 43 and 44 or a sensor as claimed in claim 19 in which a diameter or diagonal dimension of an aperture in a light-shielding film over a partitioned photoelectric conversion area satisfies the formula $\lambda \leq t \leq 2\lambda$ wherein t represents the diameter or the diagonal dimension of the aperture and λ represents the wavelength 0.650 μm of a red color. The present invention is not obvious over any combination of Meyers, Nayar, Itano, Suzuki, Tabei, Usui, Sugimori and Sonoda (assuming these references can be combined, which Applicant does not admit) because the references do not disclose all the elements of the invention recited in claims 1, 2, 19, 43 and 44.

For all of the above reasons, taken alone or in combination, Applicant respectfully requests reconsideration and withdrawal of the 35 U.S.C. § 103 rejection of claims 1, 2, 19, 43 and 44. Claims 3-18 and 41 depend from claim 1 and are allowable at least by virtue of their dependency. Claims 45-47 depend from claim 2 and are allowable at least by virtue of their dependency. Claims 20-40, 42 and 48 depend from claim 19 and are allowable at least by virtue of their dependency. Claim 49 depends from claim 44 and is allowable at least by virtue of its dependency.

CONCLUSION

In view of the above amendments and remarks, this application appears to be in condition for allowance and the Examiner is, therefore, requested to reexamine the application and pass the claims to issue.

Should there be any outstanding matters that need to be resolved in the present application, the Examiner is respectfully requested to contact Corina E. Tanasa, Registration No. 64,042, at telephone number (703) 208-4003, located in the Washington, DC area, to conduct an interview in an effort to expedite prosecution in connection with the present application.

If necessary, the Commissioner is hereby authorized in this, concurrent, and future replies, to charge payment or credit any overpayment to Deposit Account No. 02-2448 for any additional fees required under 37 C.F.R. §§ 1.16 or 1.17; particularly, extension of time fees.

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Respectfully submitted,

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